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# *Entoloma* species from New South Wales and northeastern Queensland, Australia

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Abstract — Seven new species in the Prunuloides clade of the *Entolomataceae* are described here: *Entoloma hymenidermum* is diagnosed by blackish blue basidiomata, isodiametric basidiospores and moderately broad pileocystidia; *E. violaceotinctum* has a violet-tinged pileus, violaceous-tinged stipe, and broad inflated pileocystidia; *E. discoloratum* possesses a subviscid yellow-tinged white pileus; *E. kewarra* is distinguished by its yellow pileus and stipe, both with a white and then eventually greenish yellow context; *E. pamelae* has a smooth, bright yellow, dry pileus; *E. rugosiviscosum* has a yellow-brown, rugose viscid pileus; and *E. guttulatum* is distinguished by lamellae with droplets that become reddish brown on drying.

Key words — *Basidiomycota*, phylogeny, taxonomy

## Introduction

A morphologically based classification has given rise to two interpretations of the genus *Entoloma* (*Agaricales*, *Entolomataceae*). In one approach, taxa are placed into a single genus and the subgenera are defined mostly by the pileus surface, the pileipellis structure, and the basidiospore size, shape, and angularity (Noordeloos 1992, 2005; Co-David et al. 2009; Noordeloos & Gates 2012). In a second approach, *Entoloma* is accepted in a restricted sense with additional genera recognized based on biochemical features, pigmentation, location of clamp connections, and stature types in addition to the pileus surface, the pileipellis structure, and the basidiospore size, shape, and angularity (Orton 1991, Largent 1994, Baroni & Matheny 2011, Baroni et al. 2011). Recent comprehensive phylogenetic analyses of the *Entolomataceae* have highlighted

many issues inherent with the morphologically based classifications by showing that many of the segregate genera or infrageneric groups are not monophyletic (Co-David et al. 2009; Baroni & Matheny 2011), suggesting the need to re-evaluate key characters used for delineation of segregate genera.

The majority of species of *Entoloma* s.s. are supported in one of two clades, either the Rhodopolioid or Prunuloides clade (Co-David et al. 2009, Baroni & Matheny 2011). The species described in this paper share similar features with many members of the Prunuloides clade: a tricholomatoid or naucorioid stature (Largent 1986), isodiametric basidiospores, rather short and broad hyphae in the pileus trama, and abundant clamp connections in the pileipellis.

The Prunuloides clade also accommodates segregate genera. *Entocybe* T.J. Baroni et al. was erected for species with finely pustulate basidiospores with bumps and 6–10 facets when viewed in polar view (Baroni et al. 2011). *Calliderma* (Romagn.) Largent was erected for species with a tricholomatoid stature, a pruinose, tomentose, velutinous, or rivulose pileus corresponding to a hymeniform pileipellis, and septate hyphae with or without clamp connections.

Australian field investigations from 2009–2012 within northeastern Queensland's Wet Tropics Bioregion and from 2010–2012 in the temperate rainforests of central New South Wales have uncovered several novel entolomataceous species (Largent & Abell-Davis 2011; Largent et al. 2011a,b, 2013a,b; Bergemann et al. 2013). Here, we describe seven new species representing *Entoloma* s.s.: *E. discoloratum*, *E. guttulatum, E. hymenidermum*, *E. kewarra*, *E. pamelae*, *E. rugosiviscosum*, and *E. violaceotinctum*.

## Materials & methods

### Macromorphological and micromorphological features

Techniques and equipment for collecting and describing basidiomata in the field, GPS coordinates, microscopy of dried collections including how basidiospores were measured, and digital microphotographs have been described in Largent et al. (2011a, b), while techniques for color descriptions using Kornerup & Wanscher (1978) and factors determined from mathematical analyses in the descriptions are covered in Largent et al. (2013a,b). All collections for New South Wales cited in the 'Additional collections examined' were deposited in The Plant Pathology Herbarium, Orange Agricultural Institute (DAR). Collections made in Queensland were deposited in the Australian Tropical Herbarium (CNS). All holotype and isotype collections are deposited in the herbaria designated using acronyms from Thiers (2012).

### DNA sequences and phylogenetic analyses

Thirty-four sequences from three partial genes including the mitochondrial small subunit ribosomal RNA (mtSSU), the nuclear large subunit ribosomal RNA (LSU), and second largest subunit of RNA polymerase II (RPB2) were generated for this phylogenetic analysis along with sequences obtained from GenBank (Table 1). The extraction and Polymerase Chain Reaction (PCR) protocols for the mtSSU, LSU and the RPB2 follow

Table 1. Collections used in the phylogenetic analyses. New sequences generated for this study are shown in bold. Square bracketed annotations indicate species names applied in GenBank that differ from those in the phylogram (Fig. 1).

| Species from GenBank | Collection Identifier | GenBank Accession Numbers | | |
|---|---|---|---|---|
| | | mtSSU | LSU | RPB2 |
| *Entocybe haastii* | DLL9868 | JQ793644 | JQ793651 | JQ793658 |
| | DLL10087 | JQ793645 | JQ793652 | JQ793659 |
| *Ec. nitida* [*E. nitidum*] | 7526 TJB | GU384602 | GU384626 | GU384655 |
| *Ec. nitida* [*E. alcedicolor*] | 210 | GQ289292 | GQ289152 | GQ289224 |
| *Ec. trachyospora* [*R. trachyospora*] | 5856 TJB | GU384605 | GU384629 | GU384658 |
| *Ec. turbida* [*E. turbidum*] | 27 | GQ289341 | GQ289201 | GQ289269 |
| | 6949 TJB | GQ289341 | GQ289201 | GQ289269 |
| *Ec. vinacea* [*E. vinaceum*] | 8870 TJB | GU384598 | GU384631 | GU384651 |
| ***Clitopilus* aff. *hobsonii*** | **DLL9586** | **KJ021688** | **KJ021698** | KC816912 |
| *Entoloma albomagnum* | 427 | KC710165 | KC710137 | — |
| *E. bloxamii* | 219 | GQ289294 | GQ289154 | GQ289226 |
| *E.* aff. *bloxamii* | 628 | KC710189 | KC710159 | — |
| | Thiers 53901 | KC710168 | KC710139 | — |
| *E.* aff. *whiteae* [*E. prunuloides*] | 4765 TJB | — | AY700180 | DQ385883 |
| *Entoloma* sp. [*E. haastii*] | BY21 | — | AF261309 | — |
| *Entoloma* sp. | 292, 9895 TJB | GQ289296 | GQ289156 | GQ289228 |
| *E. caccabus* | 17 | GQ289295 | GQ289155 | GQ289227 |
| *E. caesiolamellatum* [*E. bloxamii*] | 6117 TJB | — | AF261289 | — |
| *E. callidermum* | 609 | KC710183 | KC710153 | — |
| *E. calongei* | 322 | GQ289298 | GQ289158 | — |
| *E. clypeatum* | 41 | KC710164 | KC710136 | — |
| *E. coeruleogracilis* [*E. haastii*] | 216 | GQ289308 | GQ289168 | GQ289239 |
| | 217 | GQ289309 | GQ289169 | GQ289240 |
| *E. coeruleoviride* | 609 | KC710162 | KC710134 | KC710057 |
| *E. cretaceum* | 213 | GQ289302 | GQ289162 | GQ289233 |
| ***E. discoloratum*** | **DLL10217** | **JQ793646** | **JQ793653** | **JQ793660** |
| ***E. ferruginans*** | **11CA032** | **KJ021689** | **KJ021699** | **KJ021693** |
| *E. fibulatum* [*Calliderma fibulatum*] | SP393751 | — | FJ973677 | — |
| *E. flavifolium* | 6215 TJB | GU384597 | AF261301 | GU384644 |
| | 621 | KC710179 | KC710150 | — |
| ***E. fragilum*** | **MCA2415** | **KJ021690** | **KJ021700** | **KJ021694** |
| *E. fumosobrunneum* [*Entoloma* sp.] | 2005113 | KC710185 | KC710155 | — |
| | 2005120 | KC710186 | KC710156 | — |
| *E. gelatinosum* | 212 | GQ289305 | GQ289165 | GQ289236 |
| *E. griseolazulinum* | i11 | GQ289306 | GQ289166 | GQ289237 |
| ***E. guttulatum*** | **DLL9791** | — | — | **JQ793656** |
| ***E. hymenidermum*** | **DLL10025** | **JQ793648** | **JQ793642** | — |
| | **DLL10054** | — | **JQ793649** | — |
| ***E. illinitum*** | **MCA2488** | — | **KJ021701** | **KJ021695** |
| *E. indigoticoumbrinum* | 83 | GQ289318 | GQ289178 | GQ289249 |
| *E. kermandii* | 222 | GQ289313 | GQ289173 | GQ289244 |
| ***E. kewarra*** | **DLL10055** | — | **JQ793655** | **JQ793662** |
| *E. lividoalbum* | 233 | KC710182 | KC710152 | — |

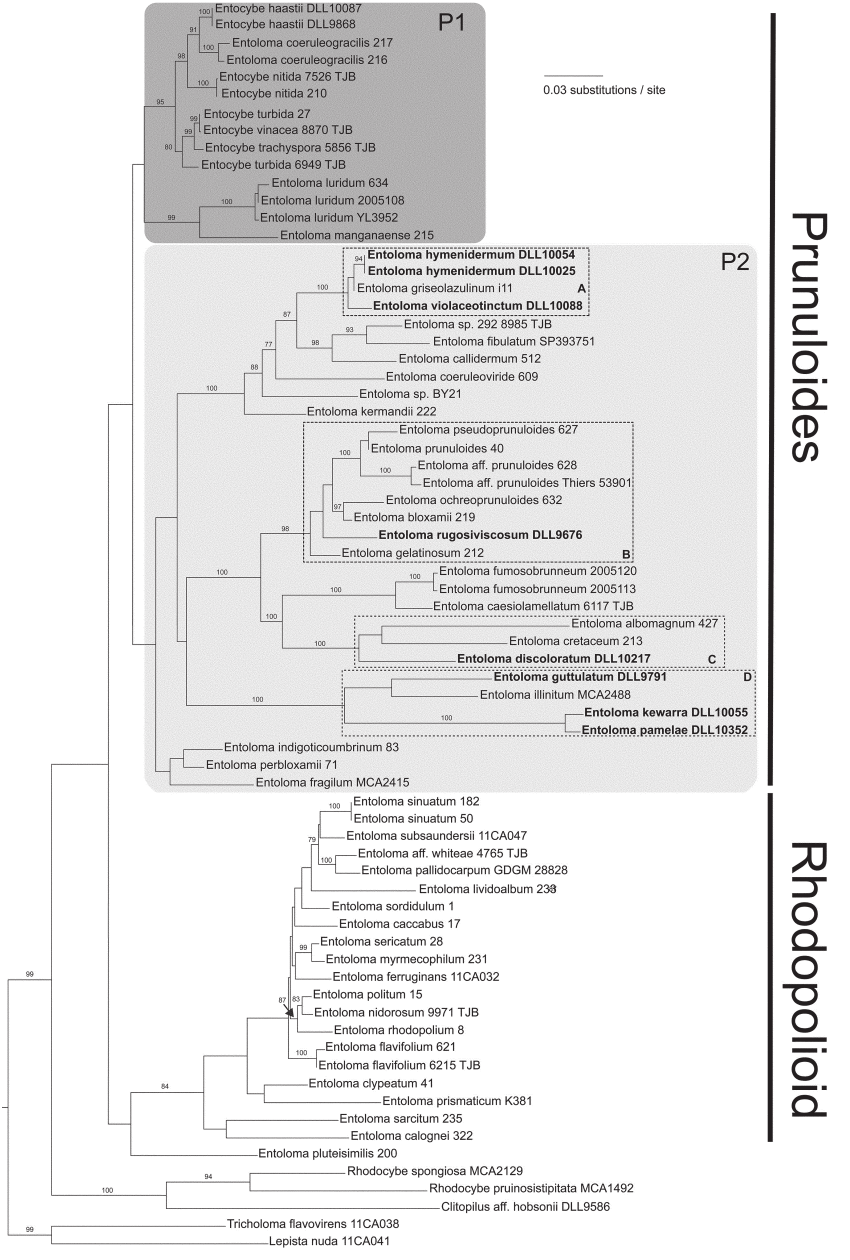
Table 1, concluded

| Species from GenBank | Collection Identifier | GenBank Accession Numbers | | |
|---|---|---|---|---|
| | | mtSSU | LSU | RPB2 |
| *E. luridum* | 2005108 | KC710175 | KC710146 | KC710192 |
| | 634 | KC710170 | KC710141 | — |
| | YL3952 | KC710177 | KC710148 | — |
| *E. manganaense* | 215 | KC710172 | KC710143 | — |
| *E. myrmecophilum* | 231 | GQ289314 | GQ289174 | GQ289245 |
| *E. nidorosum* | 9971 TJB | GU384596 | GU384617 | GU384643 |
| *E. ochreoprunuloides* [*Entoloma* sp.] | 632 | KC710176 | KC710147 | — |
| *E. pallidocarpum* | GDGM 28828 | JQ993074 | JQ410331 | JQ993080 |
| ***E. pamelae*** | **DLL10352** | — | **KJ021702** | **KJ021696** |
| *E. perbloxamii* | 71 | GQ289318 | GQ289178 | GQ289249 |
| *E. pluteisimilis* | 200 | GQ289320 | GQ289180 | GQ289251 |
| *E. politum* | 15 | GQ289321 | GQ289181 | GQ289252 |
| *E. prismaticum* | K381 | — | AB692006 | AB692016 |
| *E. prunuloides* | 40 | GQ289324 | GQ289184 | GQ289255 |
| *E. pseudoprunuloides* [*Entoloma* sp.] | 627 | KC710169 | KC710140 | — |
| *E. rhodopolium* | 8 | GQ289327 | GQ289187 | GQ289258 |
| ***E. rugosiviscosum*** | **DLL9676** | **JQ793647** | **JQ793654** | **JQ793661** |
| *E. sarcitum* | 235 | GQ289328 | GQ289188 | GQ289259 |
| *E. sericatum* | 28 | GQ289329 | GQ289189 | — |
| *E. sinuatum* | 50 | GQ289333 | GQ289193 | GQ289264 |
| | 182 | KC710184 | KC710154 | — |
| *E. sordidulum* | 1 | GQ289334 | GQ289194 | GQ289265 |
| ***E. subsaundersii*** | **11CA047** | — | **KJ021703** | **KJ021697** |
| ***E. violaceotinctum*** | **DLL10088** | **JQ793643** | **JQ793650** | **JQ793657** |
| ***Lepista nuda*** | **11CA041** | **KJ021692** | **KJ021705** | **KJ136110** |
| *Rhodocybe pruinosistipitata* | MCA1492 | GU384608 | GU384627 | GU384653 |
| *R. spongiosa* | MCA2129 | GU384604 | GU384628 | GU384657 |
| ***Tricholoma flavovirens*** | **11CA038** | **KJ021691** | **KJ021704** | KC816997 |

Largent et al. (2011b). The primer combinations rpb2-i6f and rpb2-i7r (Co-David et al. 2009), rpb2-EntF2 and rpb2-EntR4 (Largent et al. 2013b) and fRPB2-5F and bRPB2-7R (Liu et al. 1999; Matheny 2005) were also used. Sequences were generated on an Applied Biosystems 3130*xl* Genetic Analyzer at Middle Tennessee State University using the sequencing protocols outlined in Largent et al. 2011b.

Sequences were edited using Sequencher 4.2.2 (Gene Codes Corporation, Ann Arbor, MI) and an automated alignment performed using MAFFT v. 7 (Katoh & Standley 2013). Introns in the RPB2 and hypervariable regions and large introns in the mtSSU were excluded prior to analysis. The alignment lengths were 570 bp (mtSSU), 1506 bp (LSU), and 1165 bp (RPB2). A Maximum Likelihood analysis based on 100

Figure 1. Topology of the maximum-likelihood phylogram (mtSSU+LSU+RPB2) highlighting the subclades within the Prunuloides clade that included the new species proposed here (P1 and P2). Each sequence is labeled with the GenBank-listed isolate identifier and species placement for clusters (A–D) are described in the text. Branches with ≥70% support from 1000 rapid bootstraps are shown. *Lepista nuda, Clitopilus* aff. *hobsonii*, *Rhodocybe pruinosistipitata, R. spongiosa,* and *Tricholoma flavovirens*, served as outgroups, and the tree was rooted with *L. nuda*.


P1
P2
Prunuloides
Rhodopolioid
0.03 substitutions / site
Entocybe haastii DLL10087
Entocybe haastii DLL9868
Entoloma coeruleogracilis 217
Entoloma coeruleogracilis 216
Entocybe nitida 7526 TJB
Entocybe nitida 210
Entocybe turbida 27
Entocybe vinacea 8870 TJB
Entocybe trachyspora 5856 TJB
Entocybe turbida 6949 TJB
Entoloma luridum 634
Entoloma luridum 2005108
Entoloma luridum YL3952
Entoloma manganaense 215
Entoloma hymenidermum DLL10054
Entoloma hymenidermum DLL10025
Entoloma griseolazulinum i11
A
Entoloma violaceotinctum DLL10088
Entoloma sp. 292 8985 TJB
Entoloma fibulatum SP393751
Entoloma callidermum 512
Entoloma coeruleoviride 609
Entoloma sp. BY21
Entoloma kermandii 222
Entoloma pseudoprunuloides 627
Entoloma prunuloides 40
Entoloma aff. prunuloides 628
Entoloma aff. prunuloides Thiers 53901
Entoloma ochreoprunuloides 632
Entoloma bloxamii 219
Entoloma rugosiviscosum DLL9676
Entoloma gelatinosum 212
B
Entoloma fumosobrunneum 2005120
Entoloma fumosobrunneum 2005113
Entoloma caesiolamellatum 6117 TJB
Entoloma albomagnum 427
Entoloma cretaceum 213
Entoloma discoloratum DLL10217
C
Entoloma guttulatum DLL9791
D
Entoloma illinitum MCA2488
Entoloma kewarra DLL10055
Entoloma pamelae DLL10352
Entoloma indigoticoumbrinum 83
Entoloma perbloxamii 71
Entoloma fragilum MCA2415
Entoloma sinuatum 182
Entoloma sinuatum 50
Entoloma subsaundersii 11CA047
Entoloma aff. whiteae 4765 TJB
Entoloma pallidocarpum GDGM 28828
Entoloma lividoalbum 238
Entoloma sordidulum 1
Entoloma caccabus 17
Entoloma sericatum 28
Entoloma myrmecophilum 231
Entoloma ferruginans 11CA032
Entoloma politum 15
Entoloma nidorosum 9971 TJB
Entoloma rhodopolium 8
Entoloma flavifolium 621
Entoloma flavifolium 6215 TJB
Entoloma clypeatum 41
Entoloma prismaticum K381
Entoloma sarcitum 235
Entoloma calognei 322
Entoloma pluteisimilis 200
Rhodocybe spongiosa MCA2129
Rhodocybe pruinosistipitata MCA1492
Clitopilus aff. hobsonii DLL9586
Tricholoma flavovirens 11CA038
Lepista nuda 11CA041

ML replicates and specifying a GTRGAMMA model in RAxML-HPC v. 7.2.8 ALPHA (Stamatakis 2006) was carried out with a partitioned dataset: RPB2 (across each codon position for three partitions), and separate partitions for the mtSSU and LSU. Support values were based on bootstrap proportions on 1000 bootstrap replicates (Stamatakis et al. 2008).

## Results

The phylogenetic analysis based on combined mtSSU+LSU+RPB2 genes place all seven *Entoloma* species into the Prunuloides clade (Fig. 1). Clade P1 contains a cluster of species recognized as *Entocybe* (BS = 98) and a sister clade including *E. luridum* Hesler and *E. manganaense* G.M. Gates & Noordel. (BS = 99), a relationship that remains unsupported here. Clade P2 contains all the Australian species described in this report: 1) *Entoloma hymenidermum* and *E. violaceotinctum* cluster with several *Calliderma* species and share a close affinity with *E. griseolazulinum* Manim. & Noordel. (BS = 100, Fig. 1, A); 2) *Entoloma rugosiviscosum* clusters with *E. bloxamii* (Berk. & Broome) Sacc., *E. gelatinosum* E. Horak, and species within the *E. prunuloides* species complex (BS = 98, Fig. 1, B), whereas *E. discoloratum* cluster with *E. cretaceum* G.M. Gates & Noordel. and *E. albomagnum* G.M. Gates & Noordel. (BS = 100, Fig. 1, C); and 3) *E. guttulatum*, *E. pamelae* and *E. kewarra* cluster together with *E. illinitum* Largent & Aime (BS = 100, Fig. 1, D).

## Taxonomy

***Entoloma hymenidermum*** Largent, **sp. nov**. Plates 1–2

MycoBank MB804379

Differs from *Entoloma griseolazulinum* by the broader stipe, smaller basidia, and shorter basidiospores.

Type — Australia, Queensland, Cook Region, Yorkeys Knob coastal vine forest, within 20m of 16°49′00.3″S 145°43′49.3″E, 20 March 2011, DL Largent 10054 (**holotype** BRI; **isotype** CNS).

Etymology — named for the hymeniderm pileipellis.

Pileus 29–70 mm broad, 6.5–15.0 mm high; opaque, not hygrophanous, not translucent-striate; at first convex to broadly convex, sometimes campanulate-convex, upon expansion and maturity becoming plane and finally uplifted and undulate, sometimes broadly umbonate; entirely minutely velvety to suede-like but forming irregularly radial cracks near the margin when mature, always dull; when young blackish blue with the bluish color dominant (20F8) in the center, slightly lighter (20F6) elsewhere, on drying dark blue (20E-F6), when old blackish blue with the black color dominating (19F4); margin incurved at first, then decurved, finally plane then uplifted, entire then eroded; context 1–3 mm thick above the stipe, bluish. Odor mild, at times somewhat fragrant.

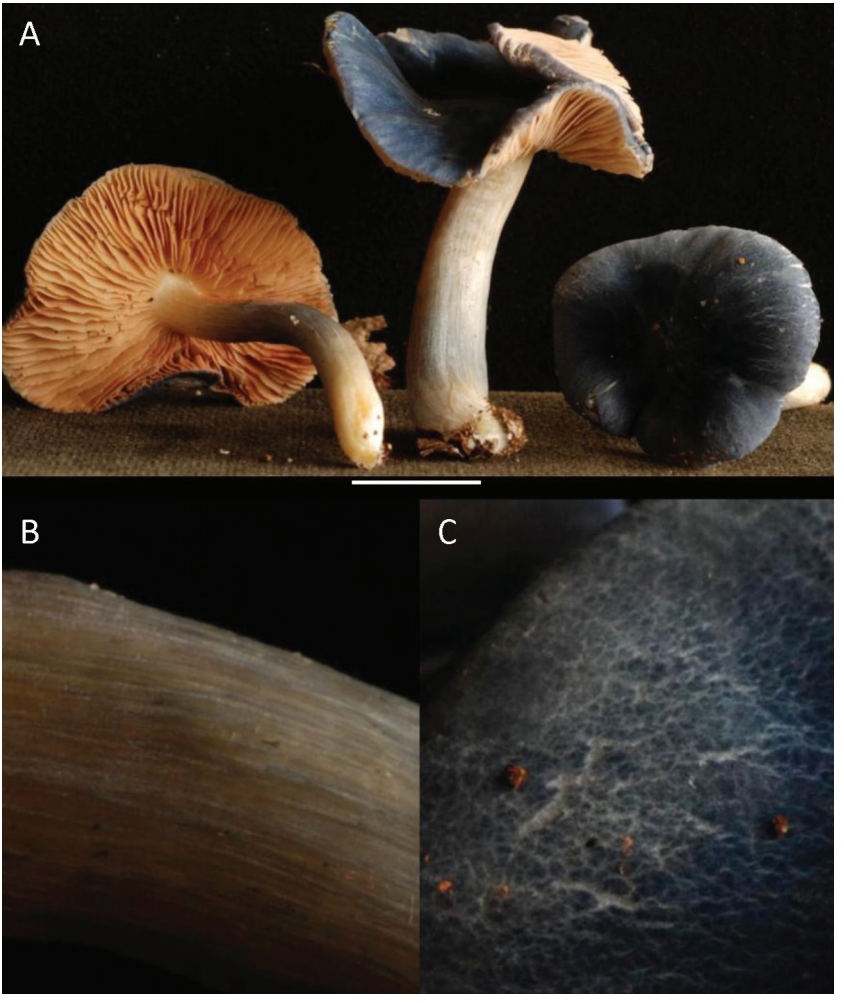



Plate 1. *Entoloma hymenidermum* (DLL10054 holotype). A. Basidiomata. B. Stipe surface. C. Pileus surface. Bar scale: A = 15 mm; B = 5 mm; C = 8 mm.

Taste mild to at times somewhat bitter. Lamellae 11–29 mm long, 2.7–10.5 mm deep, narrow to moderately broad and eventually nearly broad; uncinate to sinuate with a decurrent tooth; close then subdistant; white to between white and orange white (5A1–2) when young becoming greyish orange (5A-B4–5) or (5A3–4) with basidiospore maturation; margin smooth and concolorous. Stipe 27–79 mm long, 4–10.5 mm broad at the apex, 4–14.5 mm broad at base, equal to clavate; longitudinally appressed fibrillose from the apex to the basal tomentum, markedly striate, and sometimes twisted; fibrils various

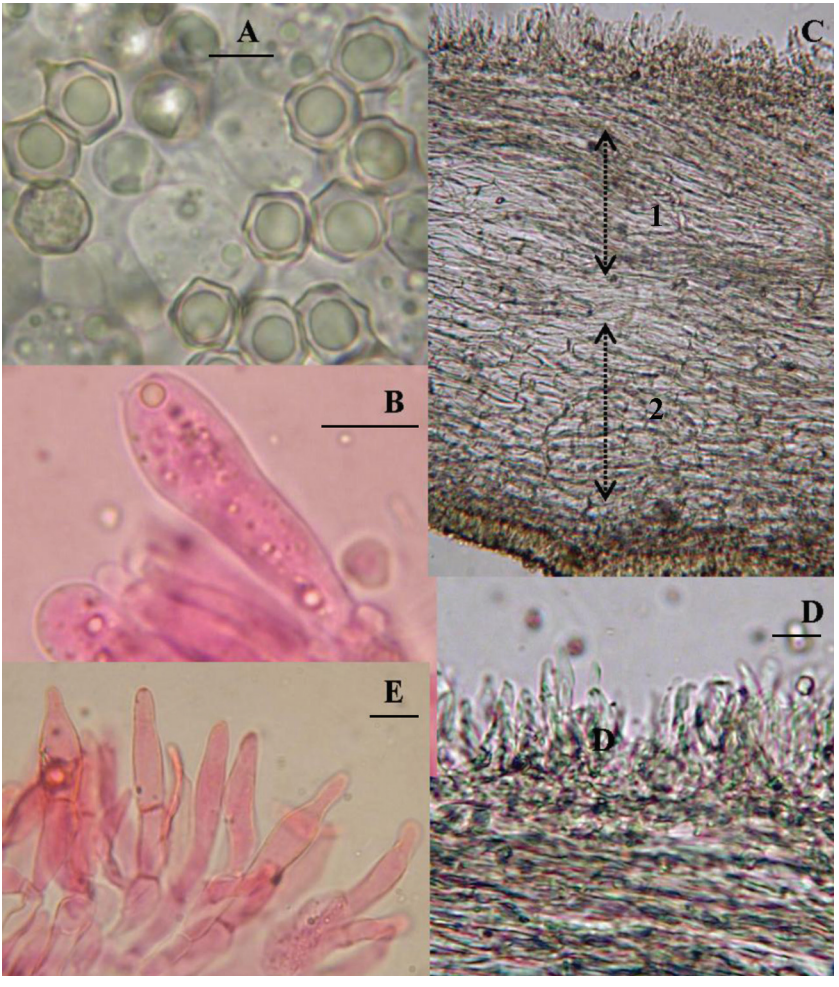



Plate 2. *Entoloma hymenidermum* (DLL10054 holotype). A. Basidiospores. B. Basidium, basidioles. C. Pileipellis radial section at pileus disc; pileal trama cylindric hyphae (top arrows), broad hyphae (bottom arrows). D. Pileipellis (calliderm and outer pileal trama). E. Pileipellis, a calliderm (section slightly squashed). Bars: A = 8 µm; B = 12 µm; C1 = 190 µm; C2 = 230 µm; D = 5 µm; E = 10 µm.

shades of blackish blue, more bluish (20F6) when young, fading slightly (20E4) when drying, and more blackish or dark bluish grey (19E-F3 or 4) when old, background color white, base of the stipe white; context stuffed at first, quickly becoming hollow with maturity; basal tomentum scarce, white. Bruising reactions none.

Basidiospores distinctly 5–6-angular, others are typically collapsed when mounted in 3% KOH, in profile and dorsiventral views isodiametric to subisodiametric, rarely heterodiametric, isodiametric in polar view, 6.8–10.0 (–10.4) × (5.9)6.2–8.8(–9.0) µm ($x$ = 8.3 ± 0.6 × 7.4 ± 0.6 µm; E = 1.00–1.31; Q = 1.12 ± 0.07 (isodiametric); n = 125/4). Basidia narrowly clavate and tapered, relatively long and narrow, 38.9–48.9 × 9.7–14.5 µm ($x$ = 42.8 ± 3.1 × 11.4 ± 1.32 µm; E = 3.25–4.00; Q = 3.78 ± 0.33; n = 16/2); 4-sterigmate. Sclerobasidia absent. Hymenial cystida absent. Lamellar edge fertile. Cheilocystidia and pleurocystidia absent. lamellar tramal hyphae subparallel, in the center to near the subhymenium, mostly relatively long and broad and inflated with rounded end walls, 41.0–170 × 8.5–42.1 µm, rarely long and narrow, not inflated and then 170 × 4 µm. Pileipellis 28.6–89.7 µm in depth, composed of a chain of 3–5 entangled cells, the basal portion developing from the outer layer of the pileal trama and the terminal cells erect, distinct, forming a palisade of pileocystidia that are not tightly packed. Pileocystidia versiform (cylindric, narrowly cylindro-clavate, clavate, obclavate, to ventricose-rostrate with the rostrum up to 2 µm long), 22.4–58.6 × 4.4–18.6 (–21.3) µm ($x$ = 41.6 ± 10.5 × 10.6 ± 4.5 µm; E = 1.20–6.3 (rarely 8.8–9.8); Q = 4.60 ± 2.17; n = 20/2). Pileal trama composed of 2 layers, a layer adjacent to the subhymenium, 228–312 µm in depth composed of inflated, relatively short and broad hyphae, 34.4–137.6 × 9.4–24.2 µm (n = 11/1), and a narrow layer, 119–163 µm deep, composed of cylindric entangled hyphae, 30–110 × 3–6 µm, the outer most portion forming the pileipellis. Stipitipellis a cutis. Caulocystidia and hymenial clusters absent. Oleiferous hyphae present in the subhymenium. Brilliant granules and lipoid globules absent. Pigmentation cytoplasmic in the pileipellis, in 3% KOH at first bluish brown and then colorless due to its solubility in the medium. Clamp connections present in all tissues, small and inconspicuous, easily observed in the branched portion of the pileal tramal hyphae just beneath the pileipellis.

Ecology & distribution — At times abundant, scattered, or solitary in sandy humus with leaf litter, in coastal vine forest near *Maytenus fasciculiflora* Jessup, *Canarium australianum* F. Muell. var. *australianum*, *Polyalthia nitidissima* Benth., and *Guioa acutifolia* Radlk., often adjacent to *Drynaria sparsisora* (Desv.) T. Moore, and at times sheltered by decaying logs and at other times near the mangrove zone, Clifton Beach to Yorkeys Knob Beach, northern Queensland, early to late March.

Additional collections examined — **AUSTRALIA**. **Queensland**, Cook Region, Clifton Beach, 16°48′50.6″S 145°43′46.6″E, 9 March 2010, PN 016, PN 017; Yorkeys Knob, 16°45′45.7″S 145°40′29.6″E, 29 January 2011, PN 51 3 February 2011, PN 56; 16°48′33″S 145°40′32″E, 8 March 2010, PN 012; 10 March 2010, PN 012A; 16°45′43.8″S 145°40′27.5″E, 14 March 2011, DL Largent 10025.

Distinctive characters — Tricholomatoid basidiomata, minutely velvety bluish black pileus, longitudinally appressed fibrillose dark bluish grey stipe, 2-layered pileal trama, and basidiospores averaging 8 × 7 µm.

Comments — In the phylogeny, *E. hymenidermum* and *E. violaceotinctum* cluster with species that have bluish basidiomata with a finely to distinctly velutinous or tomentose pileus surface, a hymeniform-type (calliderm or erect trichoderm) pileipellis, strongly and distinctly angular basidiospores, and an outer pileus trama of cylindric cells, at least on the disc. Species with a hymeniform type pileipellis are often recognized in *Calliderma* (Aime et al. 2010; Karstedt & Capelari 2010). However, *E. kermandii* G.M. Gates & Noordel., which also falls in this clade, possesses a cutis, a feature inconsistent with the generic circumscription of *Calliderma*. Furthermore, *C. pruinatocutis* (E. Horak) Karstedt & Capelari and *C. rimosum* Karstedt & Capelari (Karstedt et al. 2010) are placed in a distant and unrelated clade (Baroni & Matheny 2011). Without support for the monophyly of *Calliderma*, we classify the species described here as *Entoloma*.

*Entoloma hymenidermum* is morphologically similar to several species that have a tricholomatoid habit, dark bluish or bluish-black tinged pileus, fibrillose stipe, 5–6 angled basidiospores, clavate to versiform pileocystidia, clamp connections on the pileipellis hyphae, and lack of cheilocystidia.

*Entoloma violaceotinctum* from New South Wales differs from *E. hymenidermum* in its larger basidiomata with violaceous tones, a stipe that discolors purplish and then brownish when handled, basidiospores averaging 9 × 8 µm, longer (47–73 µm) basidia, and occurrence in deep leaf humus and organically rich soils in a northern warm temperate rain forest. *Entoloma griseolazulinum,* described from Kerala State (India), has a more slender (3–5 mm wide) stipe, longer (10–13 µm) basidiospores, and larger (47–71 × 11–16 µm) basidia (Manimohan et al. 2006). *Calliderma indigoferum* (Ellis) Largent, collected in a swamp among mosses in New Jersey, has an indigo blue (18F3) pileus (75–100 mm broad), white ± blue-tinged blue stipe, and large clamp connections (Largent 1994). *Calliderma caeruleosplendens* Largent et al. (Pakaraima Mountains, Guyana) is distinguished by its densely matted tomentose dark blue pileus, very dark blue stipe, and its broadly clavate, napiform, or broadly obclavate pileocystidia (Aime et al. 2010). *Entoloma rugosopruinatum* Corner & E. Horak, reported from Sabah (Malaysia) and Kerala State (India), differs from all of these species primarily by the clampless hyphae (Horak 1980; Manimohan et al. 1995, 2006).

*Entoloma callidermum* (Romagn.) Noordel. & Co-David from Africa and Malaysia can be differentiated from *E. hymenidermum* by the violet and/or

bister tinges in the pileus and the stipe, 5–7-angled basidiospores, smaller basidia (27–35 × 6–11 µm), and the absence of a 2-layered lamellar tramal hyphae (Romagnesi 1956, as *Rhodophyllus callidermus*; Morgado et al. 2013). However, the original description provided by Romagnesi (1956) may include segregate species (Eyssartier et al. 2012).

*Calliderma fibulatum* Karstedt & Capelari, *Entoloma simillimum* Corner & E. Horak, *E. marinum* Corner & E. Horak, *E. ducale* E. Horak, *E. divum* Corner & E. Horak, and *E. burkilliae* Massee resemble *E. hymenidermum* and *E. violaceotinctum* in basidiome color and the pileipellis but differ in their 5–11 µm broad fusoid to cylindric pileocystidia and the presence of cheilocystidia (Horak 1980, Karstedt & Capelari 2010). *Entoloma coeruleomagnum* G.M. Gates & Noordel. differs by its palisadoderm pileipellis and *E. kermandii* by its cutis (Noordeloos & Gates 2012).

***Entoloma violaceotinctum*** Largent, **sp. nov.** PLATES 3-4

MYCOBANK MB804380

Differs from *Entoloma hymenidermum* by its pileus and stipe with violet or violaceous tones, stipe that bruises when handled, larger basidiospores, and longer basidia.

TYPE — Australia, New South Wales, Strickland State Forest, lower track, central Hunter District, within 20m of 33°22′49″S 151°19′32″E, 14 April 2011, DL Largent 10088 (**holotype** DAR).

ETYMOLOGY — Derived from the Latin *violaceus* (= violet) + *tinctus* (= tint) for the violet tinted pileus and stipe.

PILEUS 40–100 mm broad, 7–40 mm high; opaque and even, hygrophanous, not translucent-striate; broadly umbonate at all times, convex to broadly convex at first, then plane to uplifted with age; velvety, at times appearing stippled with minute, pointy hairs; dark violet to blackish blue (18F4–5 or 19F5–6) fading to dull violet to dark blue (18–19E4–5) with a darker center (dark violet grey 17F2), dull; margin incurved then decurved, entire; context cream-colored except for the pellicle that is concolorous with the surface, 6–10 mm broad above the stipe, 1–3 mm broad at the margin. ODOR mild and fragrant in young specimens, strong but undefined in older specimens. TASTE indistinct in younger specimens, unpleasant in older specimens. LAMELLAE 15–45 mm long, 6–15 mm deep, moderately broad; adnexed and close then sinuate and subdistant, seceding with age; at first white or off-white to pale orange (5A3 or 15A2–3) then light orange (5A4) with basidiospore maturation; margin smooth and concolorous. STIPE 40–92 mm long, 6–16 mm broad at apex, 5–13 mm broad at base, at times flattened and then 17 × 7 mm at the apex and 13 × 10 mm at the very base, versiform in shape (equal, subclavate, clavate or broad at apex and more narrow at base); appressed fibrillose; fibrils medium

Plate 3. *Entoloma violaceotinctum* (DLL10088 holotype). A. Basidiomata. B. Stipe surface. C. Pileus surface. Bar: A = 20 mm; Bar scale: B. = 16 mm; C = 35 mm.

violet grey (18D2–3), base color yellowish white to light orange (4A2 or 5B3); context white, at first stuffed with maturity becoming hollow and then snaps easily; basal tomentum absent. Bruising reactions on the stipe occurs after handling, becoming purplish (18E4) and then brownish (5E4).

Basidiospores 5–6-angled, angles typically distinct, often with irregularly wavy walls in dried specimens, isodiametric to subisodiametric in profile and dorsiventral views, isodiametric in polar view, 7.8–10.2 × 7.1–9.2 µm ($x$ = 8.9

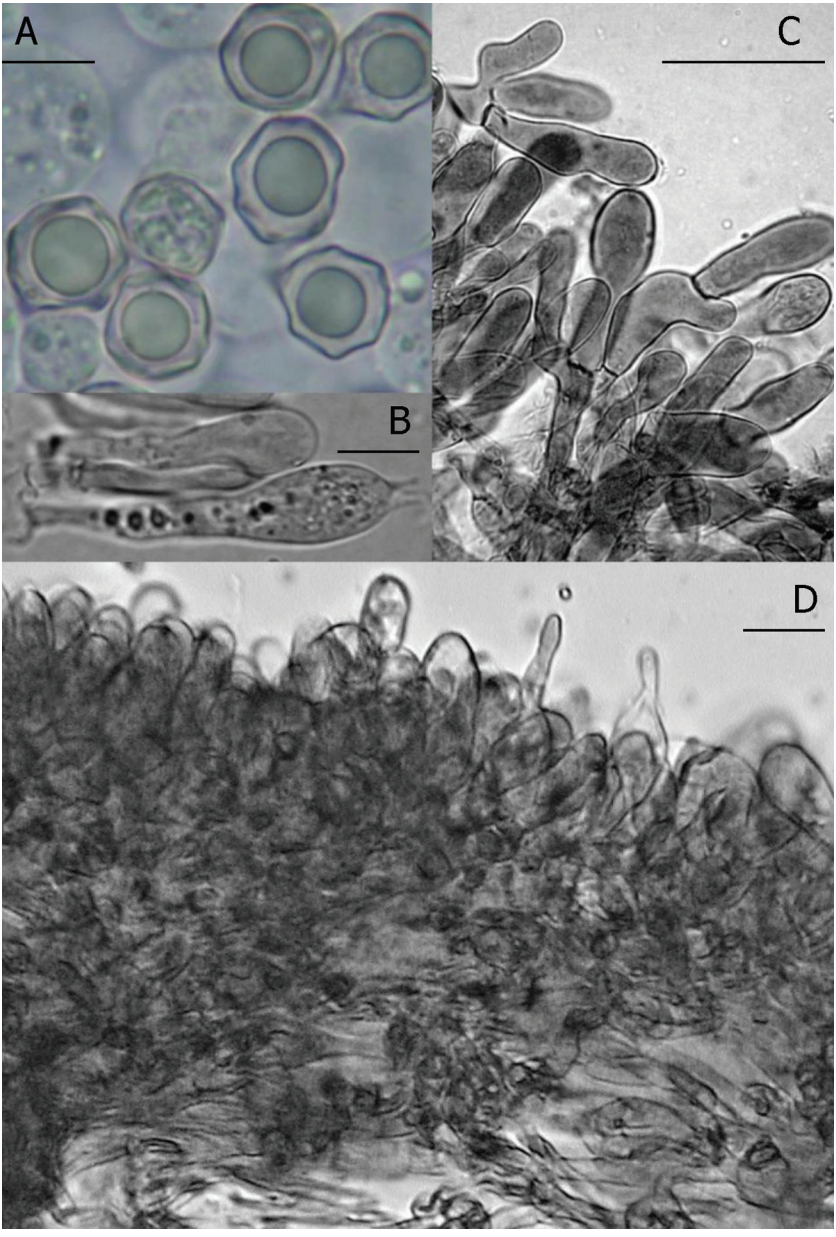



Plate 4. *Entoloma violaceotinctum* (DLL10088 holotype). A. Basidiospores. B. Basidia, basidioles. C. Pileipellis branching pattern. D. Pileipellis (calliderm and outer pileal trama). Bars: A = 8 μm; B = 13 μm; C, D = 30 μm.

± 0.7 × 8.0 ± 0.7 µm; E = 1.00–1.24; Q = 1.11 ± 0.06 (isodiametric); n = 56/2). Basidia clavate, very long and relatively narrow, often tapered to 2–3 µm, usually with rather large droplets or globules in mature forms, 4-sterigmate, 47.1–73.1 × 10.8–14.2 µm ($x$ = 57.4 ± 7.8 × 12.6 ± 0.9 µm; E = 3.63–5.77; Q = 4.57 ± 0.58; n = 25/2). Sclerobasidia absent. Hymenial cystidia absent. Lamellae in section composed of two layers, a hymenium 31–45 µm thick, subhymenium 13–22 µm thick with two lateral strata, each 17–30 µm thick, and a central layer (86–95 µm wide). Lamellar trama hyphae subparallel, relatively short, consisting of two types, slender, narrow hyphae, 61.2–113.1 × 3.3–8.0 µm (n = 9/2) forming between the subhymenium and the center of the lamellae and inflated hyphae, 39.5–105.3 × 9.5–22.2 µm (n = 22/2) found in the center. Pileipellis 36–54 µm in depth, a hymeniderm of pileocystidia, composed of entangled layer of hyphae, typically 3 cells long, with the pileocystidia as 1–3 terminal cells branching from a subterminal cell. Pileocystidia the terminal cells of branched hyphae that originate from the outer pileal trama, clavate to broadly obclavate, 29.8–82.7 × 8.2–39.3 µm ($x$ = 48.9 ± 12.3 × 14.9 ± 4.5 µm; E = 1.01–6.36; Q = 3.55 ± 1.14; n = 38/2). Pileal trama composed of two layers, an entangled layer (61–210 µm thick) with slender hyphae, 68.6–112.6 × 3.7–9.1 µm; (n = 7/1) the outer portion of which produce the pileipellis and an adjacent layer (475–539 µm thick) composed mostly of inflated hyphae, 50–237 × 12.5–26.0 µm (n = 15/2). Stipitipellis a cutis. Caulocystidia and hymenial clusters absent. Oleiferous hyphae present in the trama of the lamellae and the pileus. Brilliant hyphae and lipoid globules absent. Pigmentation cytoplasmic in the pileipellis, in 3% KOH at first bluish brown and then colorless due to its solubility in the medium. Clamp connections rather large and present in all tissues.

Ecology & distribution — Typically gregarious in mid-April, then scattered in early May, in deep leaf humus and organic rich soil, near *Syncarpia glomulifera* (Sm.) Nied., *Ceratopetalum apetalum* D. Don, and *Doryphora sassafras* Endl.), and *Schizomeria ovata* D. Don hosts, New South Wales, central Hunter District, Strickland State Forest, mid April through early May.

Additional collections examined — **AUSTRALIA. New South Wales**, central Hunter District, Strickland State Forest, lower car park area, 19 April 2011, DL Largent 10128; 33°22′47″S 151°19′28″E, DL Largent 10129; 33°22′47″S 151°19′27″E, 28 April 2011, DL Largent 10168; 33°22′47″S 151°19′28″E; 8 May 2011, DL Largent 10215; 33°22′48″S 151°19′30″E, *Banksia* loop path, 19 April 2011; 33°22′19″S, 151°19′11″E, 3 May 2011, DL Largent 10183.

Distinctive characters — Tricholomatoid basidiomata with violaceous tones, a stipe that discolors purplish then brownish when handled, basidiospores averaging 9 × 8 µm, long (47–73 µm) basidia, and its occurrence in deep leaf humus.

Comments — Refer to the Comments section under *E. hymenidermum* for a discussion of the differences among morphologically similar species.

***Entoloma discoloratum*** Largent, **sp. nov**. Plate 5

MycoBank MB804381

Differs from *Entoloma albomagnum* by its orangish pileus disc, appressed fibrillose stipe discoloring yellowish then brownish, broader lamellae, farinaceous odor without a soapy component, and sclerobasidia.

Type — Australia, New South Wales, Central Hunter District, Barrington Tops National Park, within 20 m of 32°14′25.2″S 151°43′29.8″E, 25 April 2010, DL Largent 9936 (**holotype** DAR).

Etymology — Derived from the Latin *discoloratus* (= discolored) for the discoloration of the pileus and stipe.

Pileus 64–80 mm broad, 11–18 mm high; not hygrophanous, not translucent-striate; broadly convex and broadly umbonate becoming irregularly uplifted with age; mostly glabrous but obscurely fibrillose in places particularly near the margin, dull, sticky to the touch; orange white to pale orange to light orange (5A3–4or 5A2–3) in the center, off-white elsewhere; margin decurved at first becoming plane and then uplifted, entire and rimose then quickly eroded; context white, 3–8 mm deep above the stipe, nearly non-existent at the margin. Odor of mature basidiomata distinctly farinaceous, particularly after being crushed. Taste strongly farinaceous. Lamellae 20–35 mm long, 7–15 mm deep; moderately broad to broad at first and when expanded and mature, mostly sinuate, in a few places broadly adnexed or adnate; at first crowded or close and then nearly subdistant; off-white (5A2–3); margin smooth and concolorous. Stipe 67–148 mm long, 10–21 mm broad at apex, 10–14 mm broad in the middle, 13–15 mm broad at base, tapered at the base or ventricose in the middle and then tapered; decidedly and deeply appressed fibrillose along the entire surface; off white, solid and stuffed; basal tomentum absent. Bruising reactions pileus stains or bruises greyish orange (5B4); stipe discoloring yellowish then brownish (5A2 to 5B3 or 5E-F4) when handled.

Basidiospores distinctly angular, isodiametric to subisodiametric in profile view, 6.7–8.3 × 5.8–8.5 µm ($x$ = 7.5 ± 0.48 × 7.0 ± 0.59 µm; E = 0.92–1.20; Q = 1.07 ± 0.08 (isodiametric); n = 31/1). Basidia cylindro-clavate, slender, 42.1–50.3 × 7.6–10.3 µm ($x$ = 46.0 ± 3.04 × 8.9 ± 0.89 µm; E = 4.43–6.09; Q = 5.2 ± 0.61; n = 7/1), full of large irregularly shaped globules; 2– or 4-sterigmate. Sclerobasidia rare, aborted 51–53.9 × 8.4–10.7 µm, wall 1.7–2.3 µm thick (n = 2/1), filled with large globules. Hymenial cystidia absent. Lamellar tramal hyphae subparallel, relatively long and broad, 63.2–199.7 × 13.0–29.9 µm (n = 7/1). Pileipellis 140 µm thick, an entangled ixocutis, particularly evident near the center of the pileus, hyphae just below the surface, 3.3–5.8 µm wide (n = 4/1). Pileocystidia mostly prostrate, a few semi-erect, slender,

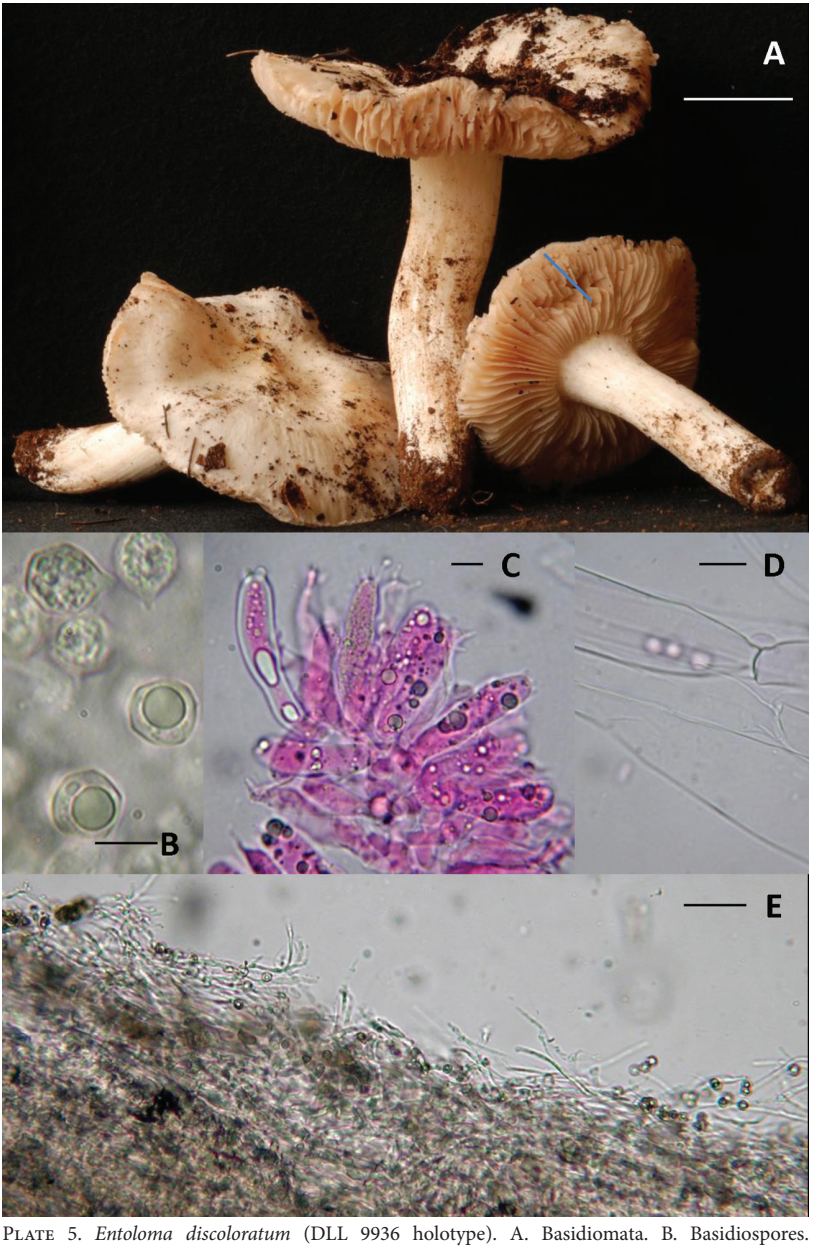



Plate 5. *Entoloma discoloratum* (DLL 9936 holotype). A. Basidiomata. B. Basidiospores. C. Sclerobasidium on left; elsewhere thin-walled basidia and basidioles (1% phloxine stain). D. Hyphae of lamellar trama, large clamp on septum of top hyphae. E. Pileipellis, an ixocutis. Bars: A = 20 mm; B = 7 µm; C = 10 µm; D = 15 µm; E = 35µm.

cylindric, 40.9–45.0 × 2.0–3.0 µm (n = 4/1). Pileal tramal hyphae similar to the lamellar trama, 76.2–169.3 × 16.9–35.3 µm (n = 7/1). Stipitipellis a cutis. Caulocystidia and hymenial clusters absent. Oleiferous hyphae abundant in the lamellar trama, end cells may extend into the subhymenium. Brilliant granules and lipoid bodies absent. Pigmentation non-existent. Clamp connections abundant at the base of the basidia, on the hyphae of the lamellar trama and pileipellis.

Ecology and distribution - Scattered to gregarious and buried in the soil and leaf litter, forming a fairy ring around *Syncarpia glomulifera* and near *Allocasuarina torulosa* (Aiton) L.A.S. Johnson, New South Wales, Barrington Tops National Park, Jerusalem Creek Track, late April to early-mid May.

Additional collections examined — **AUSTRALIA**. **New South Wales**, central Hunter District, Barrington Tops National Park, Jerusalem Creek Track. 32°14′25.2″S 151°43′29.8″E, 10 May 2010, DL Largent 9970 (**topotype** DAR); 32°14′23″S 151°43′29″E, 10 May 2011, DL Largent 10217.

Distinctive characters — Large off-white, subviscid pileus with pale yellow orange colors in the center; strongly fibrillose stipe without fibrillose flocks that eventually bruises yellowish then brown, sclerobasidia, distinctly angular basidiospores, and an ixocutis-type pileipellis.

Comments — *Entoloma discoloratum,* which clusters with *E. albomagnum* and *E. cretaceum,* can be classified in *Entoloma* sect. *Albida* Noordel. based on its white basidiomata (Noordeloos & Gates 2012).

*Entoloma albomagnum* is distinguished by its white pileus with faint yellow tinge at the center, silky fibrillose-scurfy white stipe that does not discolor, soapy odor when first collected, weakly angular basidiospores, lamellar and pileal trama composed of short barrel-shaped elements (20–90 × 4–15 µm), and the absence of sclerobasidia (Noordeloos & Gates 2012). The similarly white *E. cretaceum* from Tasmania differs in its smaller chalky white basidiomata, the white watery fibrous stipe, and rancid-farinaceous odor (Gates & Noordeloos 2007, Noordeloos & Gates 2012).

***Entoloma kewarra*** Largent, **sp. nov**. Plate 6

MycoBank MB804382

Differs from *Entoloma praeluteum* by its subviscid pileus with a pruinose bloom at first, fibrillose stipe base, white context becoming greenish yellow, ixocutis, and the intracellular pigment in the pileipellis.

Type — Australia, Queensland, Cook region, Kewarra Beach coastal vine forest. Within 20 m of 16°46′50.7″S 145°41′24.8″E, 12 March 2012, DL Largent 10275 (**holotype** BRI, **isotype** CNS).

Etymology — referring to the type locality, Kewarra Beach coastal vine forest.

Pileus 6–52 mm broad, 4–12 mm high; opaque, not hygrophanous, not translucent-striate; when immature conic-campanulate then convex, finally broadly convex to plane, at times broadly umbonate; at first entirely covered with a thin layer of yellowish white fibrils (2–3A-C7–8), with maturity the bloom showing spots when damaged or dry, eventually the surface becomes glabrous but sticky to the touch when bloom disappears; surface without bloom yellow (4A-B7) except light yellow (3 or 4A2–4) on the margin, when old and overly mature becoming entirely olive yellow (3C8); margin entire, at first incurved, when mature remaining incurved or becoming decurved; context yellowish white (3A3) becoming vivid yellow (2–3A7–8) above the stipe and slightly lighter (3A7) elsewhere, solid, and 2–6 mm thick above the stipe, 1 mm thick at the margin. Odor farinaceous and somewhat pungent. Taste bitter and farinaceous. Lamellae 2–17 mm long, 1–5 mm deep; in some narrowly adnate at first then adnexed, in most adnexed at all times, crowded then close, narrow at first then slightly more broad in some; when immature yellowish white to light yellow (4A2–3) becoming orange yellow (5A2) then light orange (4–5A4–5) with basidiospore production; margin smooth and concolorous. Stipe 25–100 mm long, 4–10 mm broad at the apex, in some flattened and 5 × 8, 10 × 13, or 13 × 15 mm broad at the apex, 5–15 mm broad in the middle, and 4–13 mm broad at the base, tapered; distinctly appressed-fibrillose; pale yellow to light yellow (2A2–3, 3A3, 4A4) becoming olive yellow (3C8) with age; context solid and stuffed then becoming hollow from the apex downward, white at first becoming greenish yellow on exposure and when cut becoming yellow (3A6–7) where hollow; basal tomentum absent. Bruising reactions stipe surface becoming pale yellow to light yellow (4A3–4) then olive or olive brown (3E-F2) where handled.

Basidiospores distinctly angular in larger basidiospores, indistinctly angular in smaller basidiospores, isodiametric to barely subisodiametric in all views, short hilar appendage, 5.3–6.8 × 5.0–6.4 µm ($x$ = 6.4 ± 0.3 × 6.0 ± 0.3 µm; E = 1.00–1.19; Q = 1.07 ± 0.05 (isodiametric); n = 32/1). Basidia with abundant granules, narrowly clavate and hardly tapered, 25.7–37.5 × 7.2–11.8 µm ($x$ = 31.5 ± 4.9 × 8.9 ± 1.2 µm; E = 2.74–4.94; Q = 3.61 ± 0.71; n = 14/2); 4-sterigmate, the sterigma short and up to 2 µm long. Sclerobasidia absent. Hymenial cystidia absent. Lamellar tramal hyphae subparallel, slightly narrow, 63.3–101.2 × 5.4–9.7 µm ($x$ = 76.0 ± 11.6 × 7.5 ± 1.62 µm; E = 7.28–15.86; Q = 10.6 ± 2.78; n = 10/1). Pileipellis an entangled ixocutis, 29.0–120.0 µm in depth. Pileocystidia narrowly cylindro-clavate, at times with a slightly inflated and minutely rostrate apex, 13.9–29.5 × 1.6–2.9 µm (n/1 = 6). Pileal tramal hyphae relatively short and narrow, 33.9–106.9 × 3.7–14.9 µm ($x$ = 55.8 ± 24.0 × 9.4 ± 3.2 µm; E = 3.16–12.65; Q = 6.67 ± 3.37; n = 12/1). Oleiferous hyphae and lipoid globules absent. Pigmentation

Plate 6. *Entoloma kewarra* (A-B DLL 10275 holotype; C-E DLL 10055). A. Basidiomata. B. Pileus surface with bloom of very finely appressed fibrils on pileal margin. C. Basidiospores. D. Basidium and basidioles (1% phloxine stain). E. Pileipellis, an ixocutis. Bar scale: A, B = 15; mm; Bars: C = 6 μm; D = 9 μm; E = 30 μm.

intracellular and yellowish in the pileipellis, exudes a yellowish green exudate in 70% ethanol, water and 3% KOH. Clamp connections present on all the tissues, narrow and small.

Ecology and distribution —Solitary to scattered in the open and in sand between a poorly defined heath community and coastal vine forest near a mangrove community in northern Queensland, Kewarra Beach, late January through late March.

Additional collections examined — **AUSTRALIA**. **Queensland**, Cook Region, Kewarra Beach, 16°46′49.7″S 145°41′23.1″E, 28 January 2011, PN 50; 4 February 2011, PN 57; 16°49′00.3″S 145°43′49.3″E, 21 March 2011, DL Largent 10055; 16°46′50.8″S 145°41′24.6″E 18 March 2012, DL Largent 10289, PN 70; DL Largent 10290, PN 72.

Distinctive characters — Basidiomata tricholomatoid and buried in the sandy substrate up to two-thirds the stipe length, pileus initially with a yellowish white pruinose bloom, subviscid pileus surface, stipe surface light or pale yellow becoming darker where handled, stipe context becoming greenish yellow with exposure, an ixocutis-type pileipellis, and narrowly clavate basidia.

Comments — *Entoloma pamelae* and *E. kewarra* are strongly supported as sister taxa in our analyses. With its bright yellow colors and tricholomatoid basidiomata, *E. pamelae* (also from northeastern Queensland) differs in its shiny dry egg-shell smooth glabrous pileus, diffracted-scaly stipe base, white context turning yellow, narrower basidia, minutely externally encrusted pigmentation in the pileipellis, and cutis-type pileipellis. Additional *Entoloma* species with similar morphological features are discussed in the Comments section under *E. pamelae*.

***Entoloma pamelae*** Largent, **sp. nov.** Plate 7

MycoBank MB804383

Differs from *Entoloma praeluteum* by its smaller pileus and stipe, fibrillose-squamulose stipe base, longer basidia, mild and indistinct odor and taste, and narrow cheilocystidia.

Type — Australia, Queensland, Cook region, Danbulla National Park, Kauri Creek Track, within 20 m of 17°07′50.6″S 145°35′57.7″E, 28 February 2010, DL Largent 9753 (**holotype** BRI, **isotype** CNS).

Etymology — in honor of Pamela Largent, the collector of the holotype.

Pileus 11–40 mm broad, 5–15 mm high; opaque, not translucent-striate, hygrophanous; convex when young and not umbonate, upon expansion and maturity becoming broadly umbonate to faintly gibbous and either remaining convex or becoming broadly convex; shiny, moist, at all times decidedly glabrous and smooth like an egg-shell; at first yellow (3A6 or 7) when hygrophanous darker yellow (3B6 or 6–7, "mustard yellow" or "Nankeen yellow"); margin entire becoming broadly lobed, decurved; context (beneath a thick yellow rind) 5–7 mm deep above the stipe, <1 mm at the very margin,

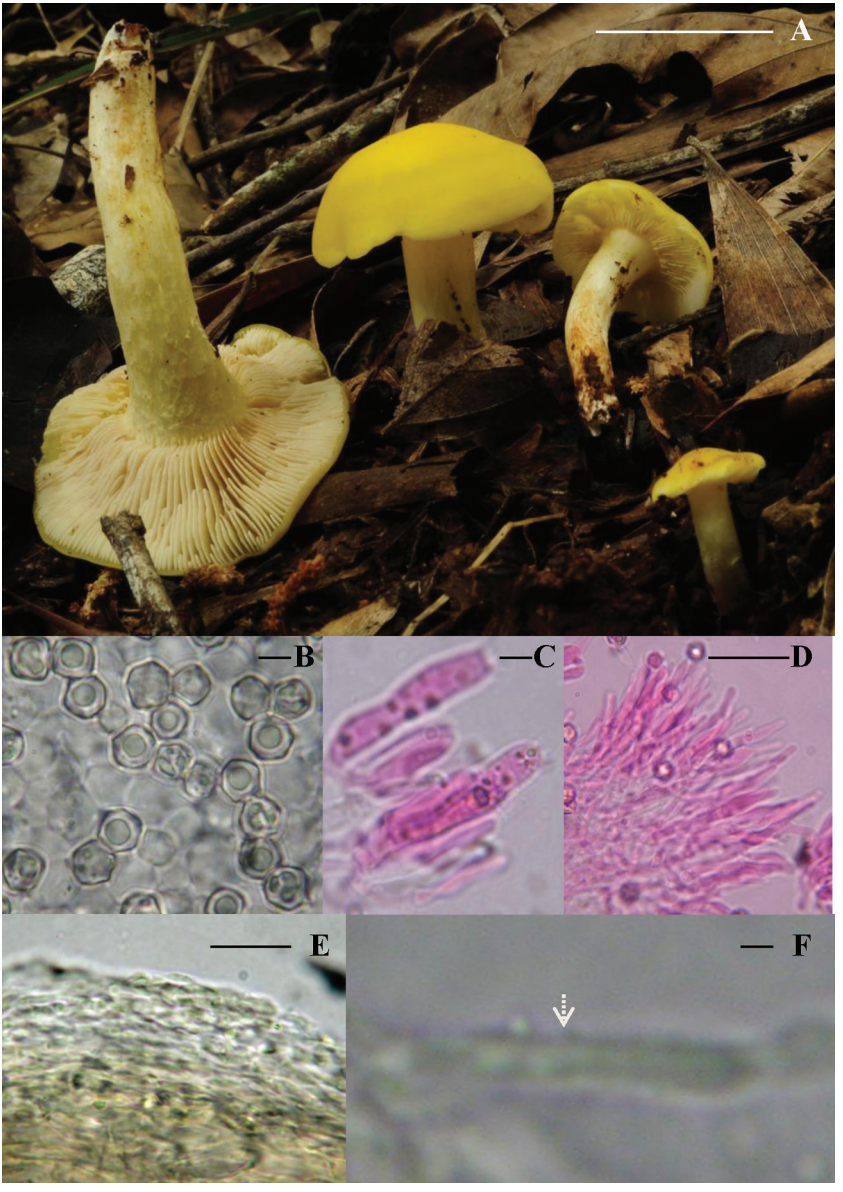



Plate 7. *Entoloma pamelae* (DLL9753 holotype) A. Basidiomata. B. Basidiospores. C. Basidia (1% phloxine stain). D. Cheilocystidia (1% phloxine stain). E. Pileipellis, a cutis. F. Pileocystidium with faint external incrustations (arrow). Bars: A = 20 mm; B, C = 5 µm; D = 20 µm; E = 15 µm; F = 3 µm.

yellow white (3A2) becoming brighter yellow (3A2–3) then pale yellow (3A3) upon exposure to air. Odor and taste indistinct and mild. Lamellae 2–20 mm long, 0.5–4.0 mm deep, when young consistently narrow then moderately broad to sigmoid; at first adnexed with maturity remaining adnexed but at times becoming sinuate, crowded then close; yellowish at first becoming pinkish with basidiospore maturity and then distinctly contrasted when compared with the pileus and stipe colors; margin concolorous with the face, smooth, at times faintly denticulate. Stipe 32–60 mm long, 5–15 mm broad at apex, 4–8 mm broad at base; consistently narrowing to the base; at first faintly appressed-fibrillose becoming distinctly-appressed fibrillose with the fibrils matted and becoming ± fibrillose-squamulose towards base; pale yellow to pastel yellow then dull yellow (3 or 4A3–4), the darker colors more evident on handling; context at first hollow in the apical ⅓ to ¼ and stuffed elsewhere, upon maturity becoming mostly hollow, white when first cut, quickly becoming yellow upon exposure to air; basal tomentum absent. Bruising reactions stipe bruises brownish on handling.

Basidiospores 5-angled in profile view, 4–5-angled in dorsiventral view, distinctly angular, small, isodiametric to heterodiametric, 5.0–7.6 × 5.1–7.3 µm ($x$ = 6.4 ± 0.53 × 6.0 ± 0.49 µm E = 0.83–1.35; Q = 1.07 ± 0.11 [isodiametric]; n = 30/1). Basidia cylindric to cylindro-clavate and very narrow 33.7–38.7 × 5.1–7.7 µm ($x$ = 35.6 ± 1.8 × 6.6 ± 0.8 µm; E = 4.60–6.56; Q = 5.4 ± 0.55; n = 9/1); 4–sterigmate. Sclerobasidia absent. Hymenial cystidia absent. Cheilocystidia cylindric to narrowly obclavate, 24–37.7 × 0.8–4.1 µm (n = 6/1), the ends of lamellar tramal hyphae protrude through the hymenium. Lamellar tramal hyphae subparallel, very narrow, 55.1–113.1 × 2.7–12.9 µm (n = 6/1). Pileipellis a periclinally arranged cutis composed of narrow, cylindric hyphae, 10–30 µm deep and with an unknown material on the outer surface that stains golden yellow in 3% KOH; pileocystidia cylindric to narrowly cylindro-clavate, 24–40 × 2.2–3.6 µm. Pileal tramal hyphae not studied. Stipitipellis a cutis. Caulocystidia and hymenial clusters absent. Oleiferous hyphae, brilliant granules, and lipoid globules absent. Pigmentation minutely incrusting the outer walls of the pileipellis hyphae. Clamp connections present at the base of the basidia, the cheilocystidia, and on the hyphae of the lamellar trama and pileipellis.

Ecology and distribution — Scattered to gregarious in leaf humus beneath an unidentified species of *Casuarina* or *Acacia* in a dry sclerophyll forest in northern Queensland, Danbulla National Park, Kauri Creek Track from mid-February to late March.

Additional collections examined—**AUSTRALIA. Queensland**, Cook Region, Danbulla National Park, Kauri Creek Track, 17°07′59.1″S 145°35′55.6″E, 2 March

2010, DL Largent 9763; 17°07′56.3″S 145°35′54.3″E 17 March 2010, DL Largent 9787; 17°08′02.4″S 145°35′51.7″E, 27 March 2012, DL Largent 10352.

Distinctive characters — Basidiomata yellow in contrast to the pinkish mature lamella, narrow yellowish immature lamellae, pileus glabrous and smooth like the surface of an egg, pileal context pale yellow beneath a thick bright yellow rind, small ($x$ = 6.4 × 6.0 µm) distinctly angular basidiospores, cylindric to obclavate cheilocystidia, minutely encrusted pigment on the external pileipellis hyphal walls.

Comments — *Entoloma praeluteum* Corner & E. Horak (from Malaysia) differs from *E. pamelae* by the larger (40–80 mm broad) pileus, longer (50–80 mm) stipe, farinaceous odor, shorter (25–30µm) basidia, and lack of cheilocystidia (Horak 1980).

*Entoloma flavidum* (Massee) Corner & E. Horak (from Singapore, Malaysia, and Kerala, India) and *E. xanthomyces* Corner & E. Horak (from Singapore) have somewhat similar basidiome colors and stature as *E. pamelae* but differ in their broader (≥140 mm) pileus and white to pallid immature lamellae that become subdecurrent or decurrent with age. Additionally, in *E. flavidum* the basidiospores are larger (9–11 × 6.5–7.5 µm) and the basidia are longer (25–65 mm long) than those of *E. pamelae* (Horak 1980; Manimohan et al. 1995, 2006).

***Entoloma rugosiviscosum*** Largent **sp. nov** Plates 8–9

MycoBank MB804384

Differs from *Entoloma conspicuum* by its smaller basidiomata, the radial rugose viscid pileus, brown stipe, and ixotrichodermium.

Type — Australia, Queensland, Cook region, Daintree National Park, Tribulation section, Marrjda Track, within 20 m of 16°08′18.5″S 145°26′26.0″E, 20 March 2009, DL Largent 9676 (**holotype** BRI, **isotype** CNS).

Etymology — from the Latin adjectives *rugosus* + *viscosus* referring to rugose viscid pileus surface.

Pileus 55–75 mm broad, 15 mm high; not hygrophanous, not striate, and not translucent; broadly convex and umbonate; shiny, viscid and sticky to the touch and remaining so 14 hours after collecting; scummy on the disc, radially-rugose elsewhere; medium dark yellow brown (5E-F5) on the disc and brownish orange to light brown (5C-D4–5) elsewhere, eventually entirely greyish orange with age and fading; margin greyish orange (5B2–3), decurved and even, elastic, and extends past lamellae up to 2 mm; context solid, brownish beneath the cuticle, white elsewhere, 10 mm broad above the stipe apex, 1–1.5 mm at the margin. odor mild to mildly pungent. Taste mild. Lamellae 25–26 mm long, 11–13 mm deep; uncinate to adnexed, at times nearly free; white at first; subdistant, more or less ventricose and broad; margin smooth then eroded with age,

Plate 8. *Entoloma rugosiviscosum* (DLL9676 holotype). A. Basidiome with rugose pileus. B. Lamellae with eroded margins and stipe apex. Bar = 10 mm.

concolorous. Stipe 50–51 mm long, 11–14 mm broad at the apex, 9.5–14 mm broad in the middle, 7–15 mm broad at the base, more or less clavate-tapered, white at first discoloring yellowish (3A2–3) with age and handling, minutely

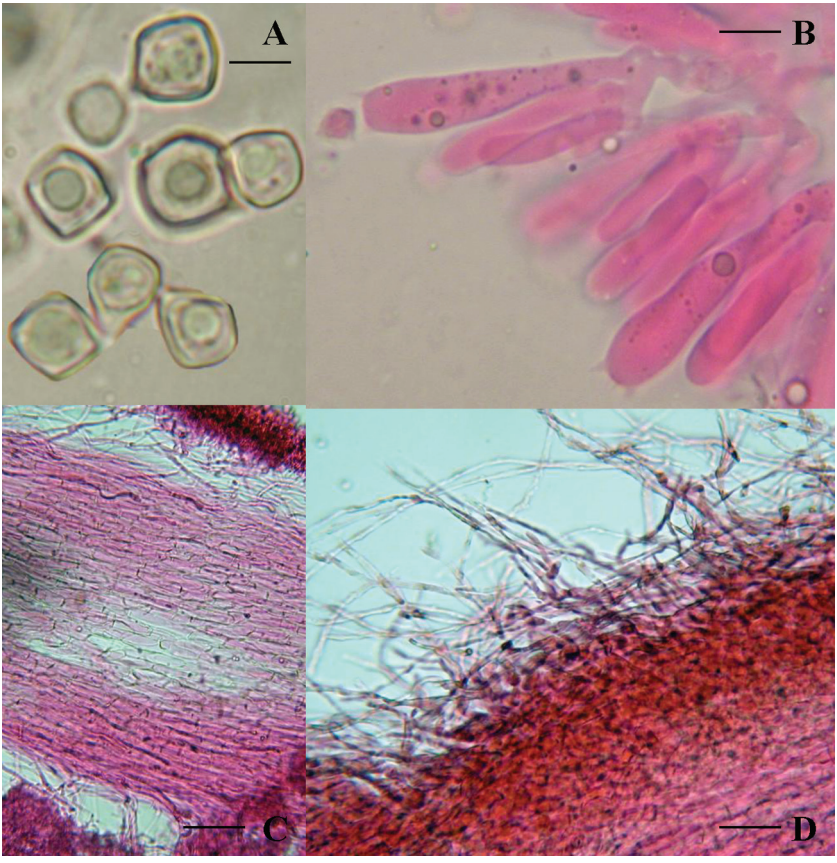



Plate 9. *Entoloma rugosiviscosum* (A. DLL9676 holotype; B–D. DLL 9644, 1% phloxine stain). A. Basidiospores. B. Basidia, basidioles, clamp connection. C. Lamellar trama with gelatinized subhymenium, section slightly squashed. D. Pileipellis, an ixotrichodermium. Bars: A = 5 µm; B = 8 µm; C, D = 40 µm.

appressed-fibrillose; flesh white, fibrous-stuffed then hollow in the center with age. Bruising reactions basidiomata discoloring yellowish with handling.

Basidiospores typically cuboidal and distinctly angular in all views, rarely 5–sided, small, 4.8–7.0 × 4.1–6.6 µm ($x$ = 5.8 ± 0.4 × 5.4 ± 0.5 µm; Q 0.87–1.25; E 1.07 ± 0.08; n = 52/2). Basidia 4-sterigmate, long and narrow, 33.1–44.7 × 6.4–9.7 µm ($x$ = 38.1 ± 3.4 × 7.99 ± 1.1 µm; Q 3.76–6.23; E 4.85 ± 0.8; n=10/1. Sclerobasidia absent. Hymenial cystidia absent. Lamellar trama 318–400 µm wide; subhymenium gelatinized and broad, 40–56 µm wide. Lamellar tramal hyphae subparallel to nearly parallel, short and broad, 38.5–102.2 × 12.7–17.6 µm. Pileipellis an ixotrichodermium with cylindric hyphae 2–3

µm diam., walls irregular and gelatinized. Pileal tramal hyphae subparallel, relatively short and broad, 61.2–133.5 × 15.2–31.0 µm. Stipitipellis a cutis but with solitary but scattered basidia-like cells at the apex. Stipe tramal hyphae nearly parallel, narrow in the outer portions, short and broad in central area and then 81.7–169.8 × 15.2–36.9 µm. Oleiferous hyphae abundant in the trama of the pileus, lamellae, and stipe. Brilliant granules and lipoid globules absent. Pigmentation cytoplasmic, brownish and uniform in the hyphae of the pileipellis. Clamp connections abundant and present in all tissues.

Ecology & distribution — Solitary, humicolous, adjacent to the pavement on the Marrdja Track, 15–50 m from parking lot, Daintree National Park, Tribulation Section.

Additional collections examined — **AUSTRALIA**. **Queensland**, Cook Region, Daintree National Park, Tribulation section, Marrjda Track, 16°08′18.5″S 145°26′26.0″E, 12 March 2009, DL Largent 9644.

Distinctive characters — Radially rugose viscid yellow brown pileus that fades to brownish orange or light brown, white stipe discoloring yellowish, basidiospores mostly cuboidal and small (4.8–7.0 × 4.1–6.6 µm), an ixotrichodermium-type pileipellis, long narrow basidia.

Comments — Phylogenetically *E. rugosiviscosum* clusters with several species including *E. prunuloides* (Fr.) Quél., *E. albomagnum,* and *E. cretaceum.* Excluding *E. ochreoprunuloides* Morgado & Noordel.), most of these species possess a tacky, sticky, subviscid, viscid, or glutinous pileus surface with an ixocutis- or ixotrichodermium-type pileipellis. *Entoloma conspicuum* E. Horak from Papua New Guinea resembles *E. rugosiviscosum* in its tricholomatoid basidiomata, brown rugose to subvenous pileus, and cuboidal basidiospores but differs by the cutis-type pileipellis and larger basidiomata (Horak 1976, 1980). *Entoloma rugosostriatum* Largent & T. W. Henkel from Guyana also has a brown rugose pileus and tricholomatoid stature but differs in its isodiametric nodulose basidiospores (Largent et al. 2008).

***Entoloma guttulatum*** Largent, **sp. nov.** Plates 10–11

MycoBank MB 807410

Differs from *Entoloma pingue* by the brown pileus, lamellae with discolored spots, larger basidia, and unusual pileipellis.

Type — Australia, Queensland, Cook region, Mossman National Park, 20 m from 16°28′17.1″S 145°19′51.2″E, 18 March 2010, DL Largent 9791 (**holotype** BRI, **isotype** CNS).

Etymology — from the Latin adjective *guttulatus* referring to droplets on the lamellar edge that dry as reddish brown spots

Pileus 80–82 mm broad, 20 mm high; opaque, not hygrophanous, not translucent-striate; not umbonate, convex then uplifted; moist, glabrous to

Plate 10. *Entoloma guttulatum* (DLL9791 holotype). A. Basidiome. B. Pileus surface. Bar = 13 mm.

the eye but under 4× to 20× subfelty or suede-like and with minute colorless pruinae; between greyish brown and yellowish brown (5D-E3–4) fading to between light orange and grayish orange (5A-B5–6) when old; margin plane then uplifted, wavy and crenulate. Odor and Taste unpleasant and slightly farinaceous. Lamellae 30–35 mm long, 9–10 mm deep, broad; adnate but a decurrent or subdecurrent tooth or subdecurrent; greyish orange (6B4) when mature; margin smooth and concolorous, with droplets as in some *Hebeloma* sp. that are abundant and dry as reddish brown spots. Stipe 60–100 mm long, 20 mm broad at the apex, 14 mm broad at base; longitudinally appressed fibrillose; grayish orange (6B4); context stuffed becoming hollow with age; basal tomentum absent. Bruising reactions stipe surface developing brownish orange to light brown (6C-D4) areas with age and handling.

Basidiospores distinctly angular, 5–6-angled, isodiametric to subisodiametric in profile view, isodiametric in polar view, 7.0–9.2 × 6.7–8.8 µm ($x$ = 8.1 ± 0.6 × 7.8 ± 0.5 µm; E = 0.9–1.3, Q = 1.04 ± 0.08 (isodiametric); n = 60/2). Basidia long and cylindro-clavate, 45.7–60.9 × 7.4–11.2 µm ($x$ = 53.5 ± 5.7 × 9.6 ± 1.3 µm; E = 4.79–6.16, Q = 5.64 ± 0.56; n = 6/1); 2- or 4-sterigmate. Sclerobasidia absent. Hymenial cystidia absent. lamellar tramal hyphae 57.6–112.2 × 8.8–13.6 µm (n = 7/1). Pileipellis 48–70 µm deep, a colorless anticlinal layer of slender, entangled hyphae, 3-4 µm in diam, beneath which is a pigmented, densely entangled layer of hyphae; terminal cells cylindric to narrowly obclavate to rostrate-ventricose, 28.2–43.0 × 3.2–5.3 µm (n = 6/1). Pileal tramal hyphae composed of broad cells. 34.9–59.9 × 7.4–16.8 µm (E = 2.54–6.13; n = 6/1). Stipitipellis a cutis. caulocystidia and hymenial clusters absent. Oleiferous hyphae, Lipoid Globules and Brilliant granules absent in the trama; basidia with abundant granules. Pigmentation colorless in the pileipellis, parietal in the entangled layer. Clamp connections present in all tissues.

Ecology & distribution — Solitary in leaf humus, Mossman and Daintree National Parks, far Northern Queensland, mid-March.

Additional collections examined — **AUSTRALIA. Queensland**, Cook Region, Daintree National Park, Tribulation section, Emmagen Creek Track, 16°02′19.7″S 145°27′41.7″E, 15 March 2010, DL Largent 9783.

Distinctive characters — Tricholomatoid basidiomata, subfelty brown pileus, lamellae with droplets drying as reddish brown spots, unpleasant taste and odor, and a pileipellis as an anticlinal layer of entangled slender colorless hyphae with narrow 3–5 µm wide terminal cells.

Comments — Phylogenetically *Entoloma guttulatum* clusters with *E. kewarra, E. pamelae,* and *E. illinitum* (from Guyana) but few morphological features

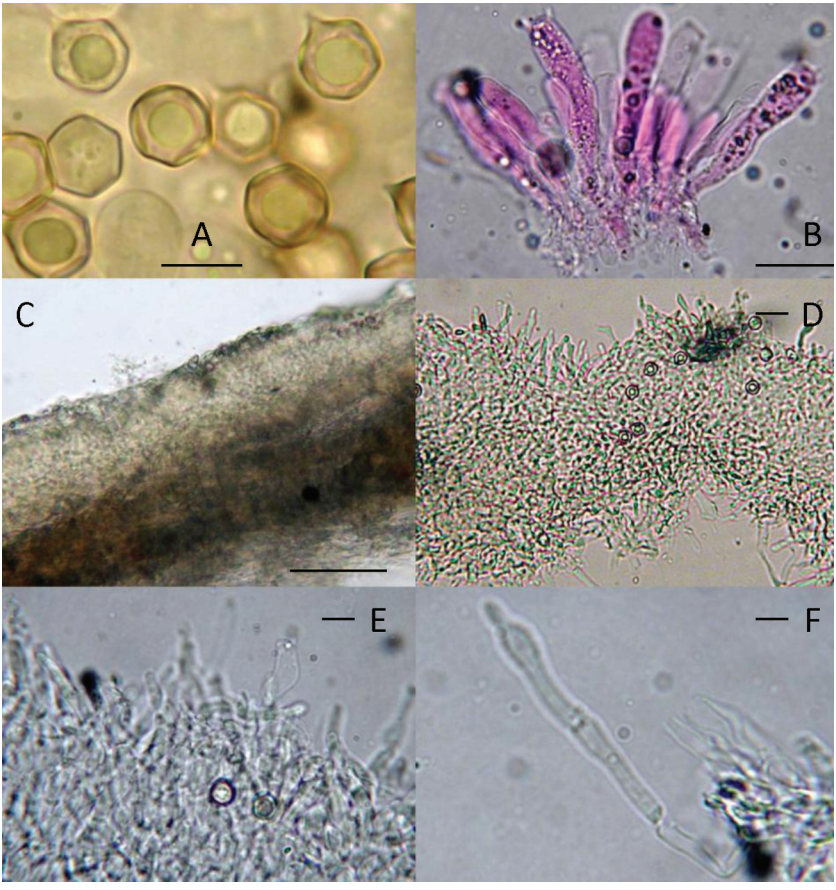



Plate 11. *Entoloma guttulatum* (DLL9791 holotype). A. Basidiospores. B. Basidia, basidioles. C. Pileipellis (radial section at pileus disc). D. Pileipellis (squash mount) E. Pileipellis (squash mount) F. Pileocystidium. Bars: A = 8 µm; B = 20 µm; C = 25 µm; D = 35 µm; E = 10 µm; F = 5 µm.

are shared between species. For example, the basidiospores are very small and distinctly angular in *E. kewarra* and *E. pamelae*, small and obscurely angular in *E. illinitum*, and large and distinctly angular in *E. guttulatum*.

*Entoloma pingue* Corner & E. Horak (from a *Casuarina* forest in the Solomon Islands), which shares a large fleshy stature, decurrent lamellae, and isodiametric basidiospores (7–9 µm diam.) with *E. guttulatum,* can be distinguished by its pale fuscous pileus, stipe changing to pale brown, white lamellae without reddish spots, 30-40 µm long basidia, and pigmented pileipellis (Horak 1980).

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